State of California
AIR RESOURCES BOARD

Innovative Product Executive Order C-U-05-005

Arkema Inc. – Innovative Product

WHEREAS, Pursuant to California Health and Safety Code sections 39600, 39601, and 43013, the California Air Resources Board (ARB) has established a certification process for evaporative emission system components designed to control gasoline emissions from small off-road engines, as described in title 13 California Code of Regulations (13 CCR), section 2767.1;

WHEREAS, Pursuant to California Health and Safety Code sections 43013 ARB has established criteria and test procedures for determining the compliance of evaporative emission system components with the design requirements in 13 CCR, section 2754;

WHEREAS, Pursuant to 13 CCR section 2767 the ARB Executive Officer may issue an Executive Order if it is determined that the small off-road engine evaporative emission system component or innovative product conforms to the applicable permeation performance requirements set forth in 13 CCR sections 2754 and 2755;

WHEREAS, Pursuant to Health and Safety Code sections 39515 and 39516, the ARB Executive Officer issued Executive Order G-05-008 delegating to the Chief of the ARB Monitoring and Laboratory Division the authority to certify small off-road engine evaporative system components and innovative products;

WHEREAS, On April 25, 2005, Arkema Inc. submitted an application for certification as an innovative product under 13 CCR section 2767(c) for a PetroSeal technology rotomolded fuel tank; and

WHEREAS, I, William V. Loscutoff, Chief of the Monitoring and Laboratory Division, find that fuel tanks produced following the process and material specifications set out in Exhibit A and Exhibit B constitutes an innovative fuel tank pursuant to 13 CCR section 2767(c). Fuel tanks produced following Arkema Inc.'s process and material specifications are hereby deemed equivalent to those tanks listed in 13 CCR section 2752 (a)(5). This finding is based on Arkema Inc.'s demonstration that such tanks have a permeation rate that is substantially lower than 1.5 grams per square meter per day set forth in the 13 CCR Section 2754 when tested at a constant temperature of 40°C using TP 901.

IT IS ORDERED AND RESOLVED that no tank permeation data is required to be submitted in the certification process for equipment using the Arkema Inc. PetroSeal technology rotomolded fuel tank.

Table 1
Dimensions and Tolerances for Arkema Inc.'s PetroSeal Technology Rotomolded Fuel Tank

Min. average barrier thickness (mm)	Min. average overall tank thickness (mm)
1	4

IT IS FURTHER ORDERED that Arkema Inc. shall provide a warranty to equipment manufacturers purchasing their PetroSeal technology rotomolded fuel tank. The warranty must conform to the requirements of 13 CCR section 2760.

IT IS FURTHER ORDERED that the certified PetroSeal technology rotomolded fuel tank shall be installed in accordance with the manufacturer's installation and use instructions for the tank. A copy of this Executive Order and tank installation and use instruction shall be provided to manufacturers purchasing PetroSeal technology rotomolded fuel tanks for installation on small off-road engines and equipment introduced into commerce in California.

IT IS FURTHER ORDERED that PetroSeal technology rotomolded fuel tank shall be clearly identified by a permanent identification that allows the ARB to identify manufacturer's name and model number.

IT IS FURTHER ORDERED that any modification of Arkema Inc.'s approved process and material specifications for producing a PetroSeal technology rotomolded fuel tank is prohibited. Any alteration or modification of the process or material specifications set out in Exhibit A and Exhibit B of this Executive Order will require the manufacturer to apply for a new Executive Order.

IT IS FURTHER ORDERED that the Arkema Inc. PetroSeal technology rotomolded fuel tank shall be compatible with fuels in common use in California at the time of certification and any modifications to comply with future California fuel requirements shall be approved in writing by the Executive Officer or Executive Officer's delegate.

IT IS FURTHER ORDERED that the innovative product certification of the Arkema Inc. PetroSeal technology rotomolded fuel tank can be referenced in certification applications for small off-road engines and equipment that use small off-road engines unless the Executive Officer finds that the Arkema Inc. PetroSeal technology rotomolded fuel tank no longer meets the performance requirements set forth in 13 CCR 2754 when tested pursuant to 13 CCR 2765.

Executed at Sacramento, California, this 14th day of September 2005.

William V. Loscutoff, Chief
Monitoring and Laboratory Division

Exhibit A

ARB Executive Order for Arkema PetroSeal™

1.0 Process Specifications

The key performance characteristics of this technology that enable it to pass the ARB SORE permeation regulations are:

a) The use of special Arkema polymers having low permeation characteristics to fuels and that are designed to adhere to one another.
b) Good adhesion between the layers so that the fuel tanks are durable.
c) A minimum average layer thickness for the Arkema Rilsan® Polyamide 11 is achieved.

1.1 Wall Thickness:

The tanks are two layer with the minimum average wall thickness for the Rilsan® Roto 11 layer of 1 millimeter and a minimum average overall tank thickness of 4 millimeters. The verification of the average wall thickness is obtained by taking the average of a minimum of 6 measurements of the wall thickness randomly taken over the entire surface of the tank. The measurements may be made by dissecting the tank and measuring the thickness with an optical comparator, vernier caliper or other similar device. The wall thickness may also be measured by suitable non-destructive methods.

1.2 Adhesion between the layers:

The polymers are designed to work as a system and as such produce good adhesion between the layers over a broad spectrum of processing conditions. Minimum average adhesion level in order to achieve a durable structure is considered to be greater than or equal to 20 Newtons/cm when tested in a T-Peel test according to ASTM D 1876-01.
(A total of five test samples are to be die-cut into ½ in. x 5 in. strips using at least three areas of a tank. Then each strip is prepared for the peel test by separating the two layers apart for a length of 1 inch using a razor blade. The separated ends, are pushed apart and bent into a "T" shape so they could be pulled apart effectively when mounted between the holding clamps. Each sample is to be tested using an Instron tensile testing machine or similar. The crosshead speed is set at 1.0 in/min and the specimens are tested at a room temperature of 73°F and 50% relative humidity).

1.3 Layer Sequence:

Since there is excellent adhesion between these materials, it is also suitable for the molder to reverse the order of the polymers and then Arkema Rilsan® Roto 11 would be used as the outer layer and the Arkema PetroSeal™ Polyethylene would be used in the inner layer. The tank design features and the rotomolding process would be the same and since the majority of the fuel barrier properties are achieved by using the Rilsan® Polyamide 11 material in the tank structure, the fuel permeation requirements would easily be achieved by reversing the

layers. This would allow the molders and OEM's to be better able to spray paint these tanks where this feature is needed or desired.

1.4 Rotomolding Process:
The molding process for producing two layer fuel tanks can be done in using one of two methods listed below.

Use of a drop box to introduce the second layer
Manual addition of the second layer

Overall, the process is nearly the same for both of these methods it just varies by how the inner layer material can be introduced and formed.
These processes are described as follows:

1.4.1 Use of a drop box:

The rotomolding process is capable of introducing the second layer by use of a drop box. A drop-box is an insulated chamber that sits attached to the main mold and the inner layer material is introduced into the mold after the outer material has melted and fused. The inner material enters the mold by way of some vent port or other opening where the drop-box is located. There is a gate between the mold and the drop box that opens to release the inner layer material. The process is therefore as follows:

1.4.1.1 Materials & Molding Preparation:

Both materials are weighed out according to the design requirements of the tank to achieve the minimum average thicknesses.
The outer material is added to the mold and the inner material is added to the drop box. The mold is closed and the molding process can then occur.

1.4.1.2 Molding Process:

The mold is rotated on two axes in the oven and the outer material begins to stick and coalesce until a solid molten layer is formed. When the outer material has completely melted and stuck to the mold, the inner layer is introduced into the mold via the gate in the drop box. When the inner layer has melted and fused, the mold is removed from the oven and rapid cooling begins.

1.4.1.3 Quenching the Mold:

While the mold is continuing to rotate, it is sprayed with water for a minimum time such that the mold is cool enough to touch, further air-cooling or de-molding can then occur.

1.4.2 Manual addition of the second layer

The process is identical to the drop box method except that the inner layer is added manually to the mold. When the outer layer has melted

and fused, the mold is removed from the oven and the already pre-weighed inner material is added via a hole or vent port in the mold. The mold is then placed back into the oven and rotated as normal until the inner layer has melted and fused. The remainder of the process is identical.

Exhibit B

ARB Executive Order for Arkema PetroSeal™

1.0 Material Specifications:

The Arkema materials used for purposes of producing the PetroSeal™ two layer rotationally molded fuel tanks are.

1.1 Arkema Rilsan® Roto 11:

Arkema Rilsan® Roto 11 as the inner layer (Rotomolding grade Arkema Rilsan® Polyamide 11 including Arkema product designations of Rilsan® Roto 11 Natural and Rilsan® Roto 11 Black)

1.2 Arkema PetroSeal™ Polyethylene:

Arkema PetroSeal™ Polyethylene used in the outer layer (The use of the PetroSeal™ trademark may not be possible in Europe and other parts of the world and in these cases, other Arkema product designations may be used to cover this same materials technology).